DIVERSE PATHWAYS TO DEFICIENT SELF-REGULATION: IMPLICATIONS FOR DISINHIBITORY PSYCHOPATHOLOGY IN CHILDREN

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ABSTRACT. *Laboratory evidence from research employing adult subjects has revealed three different pathways to the breakdown of self-regulation. The pathways are elucidated using Gray's neuropsychological model of approach/avoidance learning: One pathway, associated with Gray's behavioral activation system (BAS), is triggered by cues for reward; another, associated with the behavioral inhibition system (BIS), is triggered by cues for punishment; and the third involves an intrinsic deficit in the automatic integration of BAS and BIS processes which results in more widespread self-regulatory problems. We propose that childhood disinhibition also reflects diverse etiological processes and review the potential implications of our proposals for the development of conduct disorder, attention deficit hyperactivity disorder, and several "comorbid" syndromes (i.e., those manifesting multiple dimensions of psychopathology).*

When people have difficulty regulating their thoughts and feelings as they do in schizophrenia and depression, it seems natural to attribute their problem to psychopathology. However, when a person's behavior is poorly regulated we are apt to attribute the problem to inadequate motivation or maliciousness. Although we find it plausible that thoughts and feelings may escape voluntary control, we have trouble thinking about behavior in the same way.

Difficulty conceptualizing the psychological processes that contribute to the breakdown of self-regulation is, in our view, a major factor limiting progress in the field of disinhibitory psychopathology. An effective theoretical perspective is needed to promote intuitive understanding of this problem, arouse interest in the etiology and treatment of the problem, and generate research designed to contrast alternative hypotheses. Moreover, without compelling explanations, there is a tendency simply to blame disinhibited people for their inappropriate behavior. If, however, there are important psychobiological factors

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limiting disinhibited individuals' capacity for effective self-regulation, then negative feed-back may function instead to alienate them and disrupt their efforts to master self-control.

The primary focus of our research program is to elucidate the psychological processes underlying the impulsive, poorly regulated behavior of disinhibited adults. In pursuing this goal, we have borrowed models and concepts from physiological psychology, personality, psychopathology, and social psychology. We believe that this work has served to highlight some important concepts, useful distinctions, and challenging obstacles. In this paper we provide a brief and selective review of our progress with disinhibited adults and offer some speculations regarding the implications of this work for the breakdown of self-regulation in children. Toward this end, we discuss the theoretical framework that guides research in our lab and summarize preliminary evidence suggesting the existence of diverse mechanisms for the self-regulatory problems that characterize disinhibited individuals.

THE SEPTAL MODEL AND THE SYNDROMES OF DISINHIBITION

At a fundamental level, our theorizing about disinhibited individuals derives from a neuropsychological model of limbic system functioning, particularly the septo-hippo-campal system (SHS). In 1980, Gorenstein and Newman proposed that a group of behavioral syndromes characterized by impulsive, disinhibited behavior share a common psychological diathesis and that this predisposition could be elucidated using the more developed literature on the consequences of septal dysfunction in animals. Given the striking parallels that exit between the performance problems of animals with septal lesions and those of disinhibited individuals, we argued that the analogy could be used to generate specific hypotheses about the *psychological* processes underlying disinhibition regardless of the actual etiological significance of SHS dysfunction. These so-called "syndromes of disinhibition" included psychopathy, somatization disorder, attention deficit hyperactivity disorder, conduct disorder, early onset alcoholism, and normal impulsivity (e.g., extraversion).

What are the implications of the septal model for disinhibitory psychopathology? One important implication is that it suggests alternatives to the "insensitivity to punishment" hypothesis that has dominated thinking in psychopathy and, to a lesser degree, the other syndromes of disinhibition (Gorenstein & Newman, 1980). Although investigators have occasionally characterized animals with septal lesions as relatively insensitive to punishment, a more compelling characterization was proposed by McCleary in 1966. He described their problem as deficient *response modulation*.

Response modulation involves suspending a dominant response set (i.e., ongoing motor plan) in order to assimilate feedback from the environment. In animal experiments, deficient response modulation typically involves response perseveration or a tendency to continue some goal-directed behavior (e.g., running down the arm of a maze) despite punishment or frustrative nonreward (e.g., extinction). We regard the concept of response modulation as more general and believe that it applies whenever a person interrupts ongoing behavior in response to information arising from internal associations or feedback from the external environment. Within our framework, response modulation entails a brief shift of attention from the organization and implementation of goal-directed behavior to stimulus evaluation.

We regard response modulation as an automatic process primarily in the sense that it is either instinctive or overlearned to the degree that it is not dependent upon effortful or attention-demanding processing. Nevertheless, this largely automatic process may give rise to a more controlled examination of one's behavior which we refer to as *self-regulation*.

Following Kanfer and Gaelick (1986), we define self-regulation as the effortful monitoring, evaluating, and, if need be, altering of behavior. Although the initiation of self-regulation may in some cases be deliberate, as it is when a person attempts to alter some maladaptive behavior or when a person is "on guard," most self-regulation is initiated in response to subtle cues that automatically command attention. Consequently, we regard the response modulation process as essential for effective self-regulation. Although deficient self-regulation may often reflect lack of motivation, the septal model relates this problem to a more dynamic process involving the automatic checking of motor/behavioral plans and available information (see also Gray, 1982, 1987).

Thus, a fundamental prediction generated by the septal model is that psychopaths and other disinhibited individuals will be deficient in self-regulation if it requires response modulation. To evaluate this prediction, we adapted a card playing task developed by Siegel (1978) and tested groups of psychopathic and nonpsychopathic offenders assigned to groups using Hare's Psychopathy Checklist (Hare, 1991). At the outset of the task, subjects are encouraged to establish a dominant response set by providing them with a high rate of reinforcement for responding. However, as the task continues, responding becomes increasingly maladaptive. Thus, successful performance requires subjects to shift attention and accommodate the changing probabilities of rewards and punishments while they are engaged in the organization and implementation of goal-directed behavior.

The task involved 100 playing cards presented on a video monitor one at a time. Subjects bet on cards by pressing a button. Each time that they pressed the button and a face card appeared, they won 10 cents. Each time that a number card (2–10) appeared they lost 10 cents. Subjects were not allowed to pass cards, but they could terminate the game at any point by pressing a second button. The cards were arranged in a special órder so that 9 of the first 10 cards were face cards, 8 of the second 10 were, and so forth until the last block of cards which contained no face cards. The dependent measure was the number of cards that a subject played before quitting the game. As expected, psychopaths played significantly more cards and won significantly less money than nonpsychopaths. Because choosing an optimal time to quit the game required that subjects suspend goal-directed behavior and analyze the increasing probability of punishment, psychopaths' perseverative responding on this task is consistent with the hypothesized deficient in response modulation.

To examine the effect of providing subjects with salient feedback, another group of subjects performed the same task while being provided with a continuous and cumulative display of each card played (e.g., J, K, 9) in rows of 10 on the video monitor. Even here, psychopaths tended to play more cards than controls. However, in a third condition in which subjects were forced to suspend ongoing behavior by the imposition of a 5-s delay/feedback interval, psychopaths no longer perseverated the card playing response (see Newman, Patterson, & Kosson, 1987). Using this task or related measures, response modulation deficits have been reported in conduct-disordered (Shapiro, Quay, Hogan, & Schwartz, 1988), aggressive (Tremblay, 1992), and hyperactive children (Milich, Hartung, Martin, & Haigler, 1993) and in sons of alcoholics (Giancola, Peterson, & Pihl, 1993).

While the card playing task has been relatively successful in discriminating between disinhibited and nondisinhibited subject groups, the results are open to a variety of interpretations. By its very nature, the self-regulation process entails a variety of cognitive and motivational factors including, but not limited to, (a) the strength of a person's ongoing goal-directed behavior, (b) the strength of a person's reaction to interrupting stimuli (e.g., cues for punishment, frustrative nonreward), and (c) attentional limitations that diminish a person's ability to integrate incoming information while they are engaged
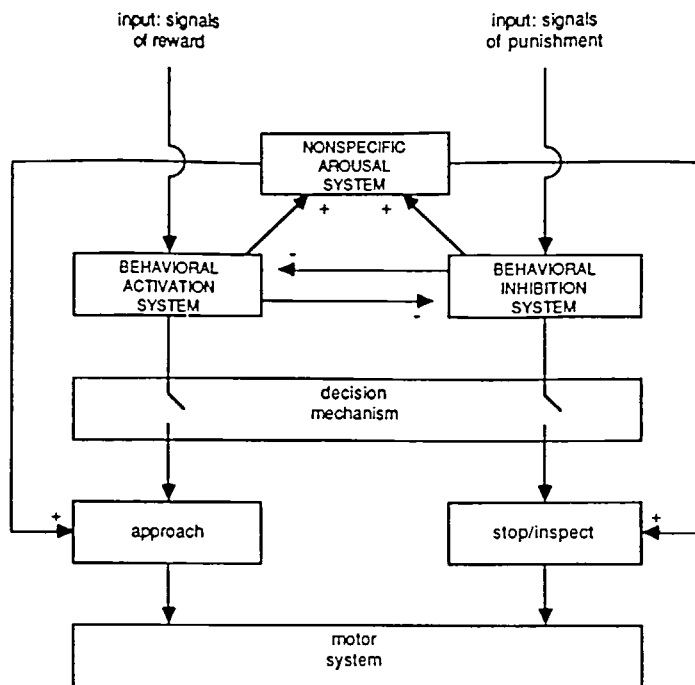
FIGURE 1. Gray's Neuropsychological Model of Approach–Avoidance Learning. From *The Psychology of Fear and Stress* by J. A. Gray, 1987, New York: Cambridge University Press. Copyright 1987 by the Cambridge University Press. Adapted by permission.

in ongoing responding (i.e., response modulation; Newman & Wallace, 1993b; Wallace, Bachorowski, & Newman, 1991).

Similarly, the response perseveration displayed by disinhibited subjects in the card playing task might reflect exaggerated approach responding as proposed by Shapiro et al. (1988), but it is no less consistent with theories postulating reduced sensitivity to punishment cues (e.g., Fowles, 1980) or deficient response modulation (Newman, 1991; Newman et al., 1987; Newman & Wallace, 1993b). Thus, specifying the psychological processes responsible for the breakdown of self-regulation requires a relatively elaborate theoretical framework capable of integrating the interwoven influences of approach motivation, avoidance motivation, and response modulation.

GRAY'S MODEL AND THREE MECHANISMS FOR IMPULSIVE RESPONDING

For more than 25 years, Jeffrey Gray has been developing a model of SHS functioning that provides an elaborate framework for integrating the components of response modulation. While Gray has focused on the significance of the SHS for anxiety and anxiety disorders (e.g., Gray, 1982), his framework is clearly applicable to impulsivity and disinhibitory psychopathology (e.g., Fowles, 1980; Gray, Owen, Davis, & Tsaltas, 1983; Quay, 1993). We, too, have found Gray's elaborate model of septo-hippocampal functioning to provide a broad and valuable context for investigating failures of self-regulation (see Newman et al., 1993; Patterson & Newman, 1993; Wallace et al., 1991).

As shown in Figure 1, Gray's model has three interacting systems: the behavioral

activation system (BAS), the behavioral inhibition system (BIS), and the nonspecific arousal system (NAS). Each system plays a crucial role in the regulation of behavior. The BAS is sensitive to cues for reward and active avoidance and functions to increase NAS activity, inhibit activity in the BIS, and initiate motor behavior in the service of approach or active avoidance. The BIS is sensitive to cues for punishment and nonreward and serves to increase NAS activity, interrupt ongoing or anticipated motor behavior, and direct attention to significant stimuli. The NAS receives inputs from both the BAS and the BIS and acts to increase the intensity (speed/force) of behavior. As indicated by the two switches in the decision mechanism that "turn on" approach behavior or the stop/ inspect response, the BAS and BIS compete to influence the focus of behavior. If BAS activation is stronger, people will maintain their focus and exhibit approach, whereas they will pause and direct attention to environmental cues if BIS activity predominates. NAS activity, on the other hand, influences qualitative rather than directional aspects of behavior. In addition to increasing the speed and force of whatever behavior eventually occurs, as proposed by Gray, increases in NAS activity may limit the amount of time and concomitant processing accorded to the simultaneous evaluation of BAS and BIS inputs before goal-directed behavior is either emitted or inhibited (see Wallace et al., 1991; Wallace & Newman, 1993). More specifically, we have proposed that when NAS activity is high, people will be quicker to commit attentional and behavioral resources to prepotent processing goals and dominant responses.[1]

Pathway I: Reward-Mediated Behavioral Activation

Using this model, alternative explanations for impulsive, poorly-regulated behavior are readily apparent. One pathway or mechanism involves the consequences of a strong BAS. As illustrated by the arrows emanating from the BAS in Figure 1, a person with a strong BAS will react to reward cues with greater NAS activity, less interruption, and a greater likelihood of approach than would a person possessing a weak BAS. This mechanism corresponds to Gray's (1981) definition of impulsivity and has much in common with the mechanism for disinhibition proposed by Gorenstein and Newman (1980; see also Newman, Gorenstein, & Kelsey, 1983). For Gray, there is a direct association between level of impulsivity and absolute strength of the BAS (Gray, 1991).

Moreover, Gray (1981) has located his dimension of impulsivity within the two-dimensional space created by the Eysenckian personality dimensions of extraversion and neuroticism (see Eysenck, 1967). According to Gray, neurotic extraverts are the most impulsive, and stable introverts the least impulsive group of subjects. Neurotic extraverts are the most sensitive to reward cues, whereas stable introverts are the least sensitive to reward cues.

According to this perspective, neurotic extraverts will be at high risk for displaying rapid, poorly regulated behavior (i.e., impulsivity) under conditions involving salient

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[1]Gray (e.g., 1991) typically distinguishes between what we have called the NAS and a fight/flight system which responds to unconditioned stimuli. Because we are as yet unconvinced of the necessity of drawing this distinction, the fight/flight system is omitted from our formulations. Within our framework, the divergent effects of encountering conditioned and unconditioned stimuli may be understood in terms of differences in intensity. In other words, like unconditioned stimuli in Gray's model, intense stimuli are postulated to engender instinctive (fight, flight) or overlearned (automatic) responses in accord with the perceived stimulus intensity.

reward cues. In the presence of reward cues, neurotic extraverts would be predisposed to display approach behavior that is more vigorous and more resistent to BIS-mediated interruption in comparison to stable introverts (i.e., nonimpulsives). Although excessive activation by approach cues would, theoretically, be sufficient to engender impulsive behavior in anyone, neurotic extraverts are particularly susceptible to such activation (Wallace et al., 1991).

Consistent with this theorizing, we have found that neurotic extraverts behave more impulsively than stable introverts in several experiments involving rewards and other salient approach stimuli. Conversely, using the same performance measures, group differences in impulsivity were not observed under conditions involving salient BIS as opposed to BAS inputs. For example, using a motor inhibition task in which subjects are instructed to trace a circle as slowly as possible, neurotic extraverts displayed significantly poorer motor control (i.e., faster tracings) than stable introverts while simultaneously playing a game of chance in which they could win $3.00. Yet, these groups did not differ on the same task when the game involved the prospect of losing $3.00 (see Wallace & Newman, 1990).

Two experiments reported by Patterson, Kosson, and Newman (1987) provide preliminary evidence that, in the presence of reward cues, neurotic extraverts display approach responses that are relatively resistant to BIS-mediated interruption. In one experiment, subjects performed a discrimination task in which they won money for pressing a button when certain numbers were present and lost money for pressing when other numbers were present. The two-digit numbers were displayed on a computer monitor one at a time and subjects were instructed to use trial-and-error to learn when to press and when not to press in order to maximize their earning. Feedback was provided after every response. Moreover, although subjects were not informed of the fact, response times were recorded by the computer administering the task. By subtracting subjects' response times after reward from their response times after punishment, we were able to assess the extent to which negative feedback *interrupted* the approach behavior of impulsive and nonimpulsive subjects.

Analysis of the response time data demonstrated that neurotic extraverts paused less following punishments than did nonimpulsive subjects. Moreover, across groups, pausing after punishment was significantly correlated with learning to avoid punished responses. The longer that subjects paused after punishment (presumably to process the feedback), the fewer punished errors they made, even after controlling for overall response speed. Finally, consistent with the significant relation between pausing and learning from punishment, neurotic extraverts were significantly more likely to emit inappropriate (i.e., punished) approach responses.

Summary. One mechanism that may contribute to disinhibited behavior concerns the consequences of excessive activation by reward. In the case of neurotic extraverts, for instance, cues for reward appear to engender rapid, highly focused approach behavior that is resistant to interruption. Moreover, to the extent that this activation interferes with pausing to process negative feedback, it appears to preclude the encoding of associative links that are needed for avoiding the same mistakes in the future (see Patterson & Newman, 1993, for further consequences of this nonreflective reaction to punishment). Finally, it is worth noting that although extraverts appear to be more sensitive to reward cues than introverts, our research has demonstrated repeatedly that the behavioral activation engendered by cues for reward is most pronounced in neurotic extraverts (e.g., Nichols & Newman, 1986; Patterson et al., 1987, Wallace & Newman, 1990).

Pathway II: Punishment-Mediated Behavioral Activation

An essential aspect of the circle-tracing data described above is that the impulsivity displayed by neurotic extraverts is situation-specific: They traced more rapidly than stable introverts under conditions involving salient reward cues, but the groups performed quite similarly under conditions involving inputs to the BIS. The situation-specific nature of these findings highlights the role of reward in moderating the impulsivity of neurotic extraverts.

In stark contrast, group differences in speed of tracing under BIS conditions were found along Gray's anxiety dimension. It was these findings that prompted us to investigate a second pathway to the breakdown of self-regulation. Gray's anxiety dimension runs perpendicular to his impulsivity dimension, with neurotic introverts inclined to high anxiety and stable extraverts inclined to low anxiety. Moreover, Gray (1981) equates anxiety with the absolute strength of the BIS: Neurotic introverts are characterized as hypersensitive to BIS inputs, whereas stable extraverts are relatively insensitive to such stimuli.

Here, too, results for the circle-tracing task are consistent with Gray's mapping of personality onto stimulus sensitivities. Under conditions designed to activate the BIS, neurotic introverts typically display the fastest tracings, whereas stable extraverts display the slowest tracings, with the other two groups displaying intermediate tracing speeds (Bachorowski & Newman, 1990; Wallace & Newman, 1990; see also Nichols & Newman, 1986). Moreover, as was the case with high and low impulsive subjects, group differences along Gray's anxiety dimension are relatively specific to the experimental condition involving subjects' putative stimulus sensitivities. Wallace et al. (1991) described the rapid responding of neurotic introverts induced by inputs to the BIS as "anxious impulsivity."

The phenomenon of anxious impulsivity is difficult to reconcile with depictions of anxious individuals as withdrawn and overinhibited. However, some situations do not readily lend themselves to response inhibition or withdrawal. In the circle-tracing task, for instance, subjects are not allowed to stop tracing, and so subjects must regulate their response speed as they continue to trace. Such constraints appear to be crucial for exposing the self-regulatory problems of neurotic introverts (Wallace et al. 1991).

Given a choice, we assume that most neurotic introverts would prefer to withdraw and engage in cognitive processing because this is their dominant or habitual response style (Brebner & Cooper, 1974; Eysenck & Rachman, 1971). Apparently, though, this response bias may be overcome by situational constraints or extensive practice which serve to establish other responses as prepotent. Regardless of whether a person responds automatically with instinctive withdrawal or some other overlearned response, however, it seems fair to say that they have failed to regulate their dominant response. Such behavior appears to reflect unchecked reactions rather than deliberate processing. In this regard, we have speculated that a similar process underlies the tendency of anxious individuals to acquire a variety of inflexible, maladaptive behaviors including compulsive rituals, phobic avoidance reactions, certain types of alcohol consumption, pathological gambling, and reactive aggression (Newman & Wallace, 1993c; Wallace & Newman, 1993).

Summary. A second pathway to disinhibited behavior involves a punishment (BIS)-mediated increase in NAS activity that promotes rapid responding and short-circuits cognitive control. In conjunction with the pathway involving reward (BAS)-mediated increases in NAS activity, this pathway suggests a more general process that may interfere with the self-regulation of behavior, as described in the next section.

NAS, Information Processing, and Self-Regulation

The combination of BAS-mediated impulsivity displayed by neurotic extraverts and BIS-mediated impulsivity displayed by neurotic introverts highlights the role of Gray's NAS in contributing to the dysregulation of dominant responses in situations involving motivationally significant cues. As shown in Figure 1, both the BAS and BIS increase activity in the NAS. Thus, even though the antecedent conditions engendering NAS activity are different, the first two pathways to dysregulation involve high levels of NAS activation.

More generally, our findings with neurotic introverts and neurotic extraverts have led us to propose that whenever people experience high levels of NAS activity in conjunction with motivationally significant stimuli (e.g., reward cues for neurotic extraverts, punishment cues for neurotic introverts), they are at high risk to respond in an impulsive, poorly regulated fashion (Wallace & Newman, 1993). A similar proposal regarding the self-regulatory failures (i.e., relapse) of drug abusers has been proposed by Tiffany (1990), and preliminary evidence supporting the hypothesis for subjects with high anxiety, eating disorders, and discrepant self-concepts has been provided by Newman et al. (1993).

How does high NAS activity interfere with self-regulation? As discussed in the previous section, NAS activity promotes rapid responding and reduces opportunities for self-regulation. In addition, we have proposed that high NAS activity increases the amount of attention that is automatically directed to significant or meaningful stimuli (Wallace & Newman, 1993). Returning to Gray's model, when people encounter unexpected problems or opportunities in the environment, they trigger increases in BIS or BAS activity, respectively. Activity in these systems increments NAS activity which, in turn, strengthens the automatic allocation of attention to motivationally significant stimuli and facilitates automatic motor responses associated with these stimuli. In essence, the NAS is an adaptive, energizing system that facilitates rapid action in emergency situations. Under such circumstances, an individual's behavior is likely to reflect highly prepared responses such as initiating active avoidance, approaching a desirable goal, and defensive attack, as well as acquired responses that have become relatively automatic due to extensive practice.

Although the implementation of relatively automatic *motor* responses may serve an adaptive function in facilitating rapid responding in emergency situations, there is a tradeoff: In fact, the very characteristics which make them adaptive (i.e., rapid, forceful, and relatively automatic) cause them to be difficult to regulate. Consequently, such responses may be emitted even though they are poorly suited to or even contraindicated by the situation. Excessive NAS activity, therefore, may often result in the rapid initiation and forceful implementation of behavior that is inappropriate and difficult to regulate (see Wallace et al., 1991).

There is also a tradeoff associated with the automatic direction of *attention* to motivationally significant stimuli. To the extent that active attention is allocated to significant cues, it is not available to support controlled, cognitive processing which, in turn, is required for self-regulation (Gilbert, 1989; Kanfer & Gaelick, 1986). Thus, because NAS activity increases the amount of attention automatically directed to motivationally significant cues, it reduces the amount of attention available for controlled information processing and self-regulation.

To summarize, (a) when people encounter motivationally significant cues in their environment, they experience increases in NAS activity; (b) increases in NAS activity increases the amount of attention automatically directed to motivationally significant cues; (c) the automatic allocation of attention to motivationally significant cues precludes

allocation of attentional resources to support the attention-demanding processing that underlies self-regulation; and (d) to the extent that self-regulatory processing is compromised, behavior will tend to reflect relatively automatic response inclinations stemming from innate, acquired, or situation-specific response biases (Wallace & Newman, 1993).

Pathway III: Intrinsic Problems in Response Modulation

The third pathway to deficient self-regulation involves a fundamental deficit in response modulation. Like other automatic attention responses, response modulation is likely to be influenced by a person's cognitive–motivational set (e.g., Pritchard, 1981). For example, a person who is overly intent upon reaching a goal or relatively unconcerned about performance may display relatively few automatic shifts of attention from the organization and implementation of goal-directed behavior to its evaluation (see Wallace et al., 1991). Apart from such influences, however, we propose that some individuals have an intrinsic deficit in the ability to switch attention while they are actively engaged in the organization and implementation of goal-directed behavior. For such individuals, deficient response modulation is not a consequence of their motivational state, but a fundamental deficiency that impedes self-regulation across a wide range of situations requiring automatic shifts of attention.

The process of response modulation has received remarkably little attention and consequently is not well understood. Although this lack of development and familiarity make it somewhat difficult to understand, we believe that response modulation is essential for maintaining perspective on behavior and for initiating self-regulation. More specifically, response modulation allows a person to organize and implement motor plans while simultaneously monitoring environmental cues and proprioceptive feedback and thus facilitates the fine-tuning of behavior. Shapiro (1965) characterized this crucial aspect of self-regulation as an integrative process whereby transient desires (e.g., whims) become elaborated by the accrual of associations which lend meaning, affective depth, and historical context to the anticipated action. By providing a stable motivational context, such associations may foster persistence in the face of frustration. Alternatively, if the associations accruing to the anticipated action are mostly negative because the behavior was punished on previous occasions, the associations will tend to inhibit the anticipated response. For Shapiro (1965), the short-circuiting of this integrative process was at the root of the impulsive cognitive style and was epitomized by the psychopath.

Like Shapiro (1965), we have proposed that primary psychopaths are characterized by a deficiency in the automatic integration of relevant information while they are engaged in the organization and implementation of goal-directed behavior. Whereas Shapiro's (1965) conclusion was derived from clinical evidence, ours is founded in laboratory research (see Newman & Wallace, 1993b, for a review.)[2] Nevertheless, we have found it very difficult to assess response modulation independently of other factors, such as approach and avoidance motivation. Consequently, to a large extent our conclusions about response modulation are dependent upon evidence ruling out these alternative explanations. Thus, we will briefly consider these competing hypotheses.

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[2]Whereas the diagnosis of antisocial personality disorder appears to be etiologically heterogeneous and is probably associated with all three pathways, the concept of psychopathy is more specific (see Hare, Hart, & Harpur, 1991). Our research on psychopathy involves incarcerated males assessed using Hare's Psychopathy Checklist (1991)—an instrument designed to identify subjects meeting the criteria outlined by Cleckley (1976).

Indeed, our original hypothesis was that the disinhibited behavior of psychopaths, like that of extraverts, was associated with a tendency to overfocus on reward cues to the extent that it interfered with their ability to process other significant stimuli such as cues for punishment and delayed reward (Gorenstein & Newman, 1980; Newman et al., 1983; Newman, Widom, & Nathan, 1985). Consistent with this proposal, psychopaths and extraverts display similar problems on tasks which require them to inhibit reward seeking in order to avoid punishment (i.e., passive avoidance learning). Furthermore, when we assessed passive avoidance learning using the same task, but without the opportunity to win money, both groups performed as well as their respective controls (Newman & Kosson, 1986; Newman et al., 1985). Based on these findings, we tentatively concluded that rewards produce a high level of behavioral activation in (neurotic) extraverts and psychopaths which, in turn, makes it difficult for them to modulate reward seeking — an explanation not unlike the first pathway described above (see Newman, 1987).

To investigate this proposal more specifically, we conducted parallel investigations in neurotic extraverts and psychopathic offenders. In particular, we examined the extent to which incarcerated psychopaths, like neurotic extraverts, displayed deficient self-regulation under conditions involving rewards only. Whereas neurotic extraverts displayed poorer motor inhibition on a circle-tracing task (Wallace & Newman, 1990), faster responding on a pattern-matching task (Nichols & Newman, 1986), and poorer delay of gratification (Newman & Kosson, 1984) than stable introverts under experimental conditions involving monetary rewards, comparable experiments conducted with psychopathic and nonpsychopathic offenders yielded no such differences (e.g., Newman, Kosson, & Patterson, 1992; Newman, Patterson, Howland, Nichols, 1990; Newman et al., 1985).[3] Thus, we failed to support our hypothesis that psychopaths are hyperreactive to reward cues.

An alternative explanation is that the unchecked approach responding of psychopaths reflects weak avoidance motivation or a weak BIS rather than hypersensitivity to rewards (Fowles, 1980). The weak BIS hypothesis holds that psychopaths are relatively insensitive to punishment cues. Thus, punishment cues would be expected to elicit less NAS activity, less interruption of approach behavior, and less pausing to inspect the environment. The weak BIS hypothesis is especially appealing because it provides a straightforward and satisfying explanation for the major symptoms of psychopathy. However, within the context of our research employing monetary punishments and behavioral performance measures, we have found no evidence that psychopaths are less sensitive to punishment cues than nonpsychopaths, unless there is a competing reward contingency (e.g., Arnett, Smith, & Newman, 1993; Newman & Kosson, 1986; Newman et al., 1990). Findings reported by Lykken (1957) and Schmauk (1970) are often cited to support this hypothesis, but the punishment contingencies used in these studies were not part of the "manifest" task (i.e., they were part of a latent avoidance contingency). Accordingly, learning to avoid punished errors required subjects to suspend their goal-directed behavior and actively analyze the occurrence of electric shocks in order to realize that, contrary to instruc-

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[3]Despite numerous studies, only one provides any evidence of group differences in reward-only conditions. This study employed a serial reaction time paradigm (Arnett, Smith, & Newman, 1993). Following a baseline period of responding without incentives, subjects responded as quickly as possible to one of five buttons as the lights which were mounted above them were lit in random sequence. Interestingly, low-anxious psychopaths responded faster as the task progressed so that they were responding significantly faster than low-anxious controls by the fourth and final 2-min interval. Given that group difference developed gradually over trials, it is possible that psychopaths' rapid responding reflected strategic differences rather than simple activation by reward cues.

tions, the shocks could be avoided by inhibiting particular responses. Thus, our interpretation of these data is that deficient response modulation, and not insensitivity to punishment per se, was responsible for the observed deficits.

Overall, these laboratory findings with psychopathic offenders provide little evidence that their deficient self-regulation derives from hypersensitivity to reward stimuli or hyposensitivity to punishment stimuli per se. Yet, in spite of the fact that psychopaths are both able and motivated to avoid monetary punishments when the requirement to do so is explicit, they appear to have difficulty learning to avoid punishment when it requires automatic shifts of attention (e.g., when the punishment contingency is latent or introduced gradually as it is in the card playing task; see Newman et al., 1990). Moreover, investigations employing diverse research paradigms suggest that psychopaths are less adept at switching attention and altering the focus of their behavior once a dominant response set has been established (Arnett et al., 1993; Howland, Kosson, Patterson, & Newman, 1993; Newman et al., 1987, 1990). Thus, in contrast to Pathways I and II which involve the disinhibiting effects of motivationally significant stimuli, the self-regulatory problems of the psychopath implicate a more fundamental deficit involving the automatic reallocation of attention.

As noted earlier, self-regulation is typically initiated when an automatic attention response directs attention to environmental stimuli or stored associations that have potential relevance for ongoing behavior. Such attention responses are automatic in the sense that potentially relevant stimuli "call for" processing and attract attention even though an individual-is actively allocating attention elsewhere (see Schneider, Dumais, & Shiffrin, 1984). An intuitive example of this process involves the "cocktail party phenomenon," which refers to a person's ability to notice when someone speaks her name despite the fact that she is actively engaged in conversation and is not aware of monitoring the conversation in which her name was spoken. Names tend to elicit automatic attention responses because people have extensive practice orienting attention to the mention of their names. The cocktail party phenomenon is important because it demonstrates that people are capable of analyzing "unattended" information to the degree that it will command active attention if the information is sufficiently relevant.

The automatic attention response plays a key role in enabling such automatic shifts of attention. As a person passively monitors unattended information using preattentive processes (see Pritchard, 1981), a stimulus that has reliably attracted attention in the past will tend to trigger an automatic attention response. Numerous laboratory investigations demonstrate that

> when subjects in search tasks are consistently trained to recognize certain inputs as targets, these inputs acquire the ability to initiate automatic-attention responses. These attention responses then direct attention (i.e., will direct controlled processing) automatically to the target, regardless of concurrent inputs or memory load. (Schneider & Shiffrin, 1977, p. 2)

Furthermore, by directing attention to previously unattended but potentially relevant stimuli, automatic attention responses engender a brief interruption of behavior and provide an opportunity for controlled stimulus evaluation. Of course, to the extent that a person is deficient in automatically shifting attention from the organization and implementation of goal-directed behavior, motivationally significant stimuli will fail to initiate controlled processing.

We have proposed that the self-regulatory problems of psychopaths are associated with a deficiency in this stage of information processing—that is, in the automatic allocation of attention while they are actively engaged in goal-directed behavior (Newman & Wal-

lace, 1993a, 1993b). Whereas most people are able to focus on achieving proximal goals while relying on automatic attention responses to reorient attention and initiate self-regulation when it appears to be necessary, psychopaths are deficient in this regard. Despite the fact that motivationally significant stimuli appear to trigger increases in nonspecific arousal and "call for" processing, psychopaths appear relatively unable to answer the call by automatically reallocating attention. Nevertheless, psychopaths exhibit little difficulty reallocating attention to process significant information when the requirement to do so is explicit from the outset of a task, presumably because attending to such information may be accomplished using controlled as well as automatic processing (see Newman et al., 1990).

Whereas Pathways I and II may be identified with specific components in Gray's model (viz., the BAS, BIS, NAS), the third pathway describes an interactive process according to which attention shifts automatically between the organization of goal-directed behavior (presumably mediated by the BAS) and the evaluation of unexpected, potentially significant information (presumably mediated by the BIS). Given this characterization, it appears reasonable to identify this process with the arrows connecting the BAS and BIS (see Figure 1).

Gray (1991) recently discussed the possible physiological substrate of these inhibitory links between the BAS and BIS, but the psychological processes mediating them remain rather vague. Clearly, the arrows signify that as activity in one behavioral system increases activity in the other diminishes, but by what mechanism? Our view is that these processes are mediated, in part, by automatic attention responses: Gray (1991) has noted that behavioral activation increases "in proportion to such factors as the magnitude and quality of reward, the number of previous occasions on which reward has been obtained, etc." (p. 291). Thus, activity in the BAS appears to involve the automatic activation of relevant associations which, in turn, automatically recruit attention and bias behavior in favor of approach. To the extent that attention is drawn to BAS-mediated activity, it cannot simultaneously be directed toward the processing of BIS-related associations, although attention may alternate between the two. Analogously, punishment stimuli and other inhibitory associations will automatically recruit attention, thus pulling attention away from BAS-related associations.

In implicating frequent shifts of attention, the reciprocal inhibition component of Gray's model provides a mechanism for the automatic integration of BAS- and BIS-mediating processing. In the process of accumulating information that will determine whether behavior proceeds or is interrupted, people automatically examine an array of approach and inhibitory associations. Thus, in laying the groundwork for a decision to approach or inhibit (which presumably occurs at the decision mechanism), this early stage of processing endows the individual with essential perspective on behavior. Moreover, because BAS- and BIS-mediated information is processed concurrently, the approach and inhibitory associations become blended, enabling the expression of more fine-grained behavioral decisions, such as proceeding with caution.

If, as proposed, psychopaths are deficient in the automatic switching of attention from the organization and implementation of goal-directed behavior to its evaluation, then they would have less opportunity to process the associations that lend perspective to behavior. As already noted,-such associations appear to be essential for transforming whims into determined action, inhibiting inappropriate responses, moderating the intensity of approach behavior, and initiating self-regulation.

Our proposals regarding Pathway III are quite speculative and in need of empirical investigation. Although there is preliminary evidence that lends credibility to our proposals, space limitations preclude analysis of this support (see Newman & Wallace, 1993a,

1993b). Nevertheless, we will briefly and selectively outline some of this evidence for the purpose of making our proposals more concrete and to facilitate their application to childhood disinhibition.

The most fundamental aspect of our proposal is that once goal-directed behavior is initiated or even planned (since the latter also engenders BAS activity), psychopaths will be less likely to process new information or incompatible associations generated by their response strategy (i.e., inputs to the BIS). This proposal is consistent with our finding that psychopaths were less able to accommodate the declining probability of reward in the card playing task unless they were forced to suspend approach responding during the intertrial interval (Newman et al., 1987). Psychopaths also spend less time inspecting unexpected, negative feedback in passive avoidance tasks involving monetary rewards and punishments (Newman et al., 1990).

Second, in the event that psychopaths encounter an input to the BIS while they are engaged in goal-directed behavior, such inputs will tend to increase the intensity of behavior rather than effect response inhibition. If, as proposed, the BIS is normally responsive to punishment cues but is less able to interrupt ongoing behavior, then inputs to the BIS will typically serve to increase NAS activity without engendering a concomitant increase in behavioral inhibition. Without the concomitant increase in behavioral inhibition, increases in NAS activity operate to magnify the intensity of ongoing behavior. In relating the action of antianxiety drugs to the BIS, Gray (1987) noted that they reduce both the arousal and the inhibitory components of an organism's reaction to punishment cues. Septal lesions, on the other hand, reduce the inhibitory component while leaving the arousal response essentially unchanged. A similar dissociation between arousal and inhibition appears to characterize the inhibitory and arousal components of psychopaths' reaction to punishment stimuli (Arnett et al., 1993; Howland & Newman, 1987; Newman et al., 1992).

Third, without the perspective afforded by the accrual of automatic associations to ongoing behavior, psychopaths would be forced to rely on controlled processing to regulate behavior. This proposal has much in common with Cleckley's (1976) characterization of psychopaths as maintaining a "mask of sanity." Cleckley believed that psychopaths could use their intact reasoning abilities to understand and even mimic the feelings and judgments of others, but that the product lacked spontaneity, genuineness, and depth. This proposal is also supported by preliminary laboratory evidence (see also Newman & Wallace, 1993b). For instance, unlike most people psychopaths do not experience an advantage when processing affectively significant words (Williamson, Harpur, & Hare, 1991). Because this effect is likely to depend upon automatic as opposed to controlled processing, it appears to indicate that psychopaths are less adept in the automatic processing of word meanings. Of course, having to rely upon controlled processing resources to compensate for deficiencies in the automatic integration of relevant information would necessarily extract a cost in terms of attentional capacity. In this regard, Kosson and Newman (1986) have interpreted the inferior divided attention performance of psychopaths as evidence that the overarching task of allocating attentional resources (i.e., switching attention) is more effortful (i.e., attention demanding) for psychopaths than for nonpsychopathic controls. Moreover, this proposal fits neatly with psychopaths' difficulty (a) in experiments involving latent response contingencies (e.g., Lykken, 1957; Schmauk, 1970) because mastering latent contingencies relies upon the turning of attention by automatic processes and (b) in experiments involving time pressure (Smith, Arnett, & Newman, 1992) because time constraints place greater demands on processing efficiency.

Finally, to the extent that psychopaths are forced to rely on controlled processing resources to regulate behavior, they would be especially vulnerable to dysregulation

when strong affect, fatigue, or alcohol reduces their capacity for control processing. This proposal is consistent with Cleckley's (1976) inclusion of "fantastic and uninviting behavior with drink" among the primary features of psychopathy and with data indicating that the administration of monetary punishments disrupted the ability of (low-anxious) psychopaths to delay gratification (Newman et al., 1992).

In an effort to assess the automatic interruption of goal-directed behavior by cues for punishment in psychopathic and nonpsychopathic offenders more directly, we recently developed a laboratory task involving two distinct phases. In Phase 1 subjects are instructed to respond as quickly as possible each time that a string of letters is presented *unless* one of the letters is Q. The 150 trials in Phase 1 are designed to establish Q as a cue for punishment (i.e., responses to Q result in loss of money). In Phase 2 subjects are instructed to respond as quickly as possible unless one of the four characters in the rectangular display is a number. Although Q has no relevance for performance in Phase 2, it appears on approximately 20% of the trials. By comparing a subject's response speed on Q-present and Q-absent trials, it is possible to assess the degree to which this punishment cue *automatically* interrupts subjects' approach behavior. We assume that any interrupt would be relatively automatic because Q has no relevance in the second phase.

Two studies were conducted, one involving university students and one involving prison inmates. The first study demonstrated that university students with high anxiety, as measured by the State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970), responded significantly slower on Q-present than on Q-absent trials as predicted by Gray's model (1981). Essentially the same results were obtained when neurotic introverts and stable extraverts were used to anchor the high and low ends of Gray's anxiety dimension. Inasmuch as anxious subjects are characterized by a strong BIS, these findings support our assumption that the task relates to the automatic interrupt function of the BIS.

In the study involving incarcerated subjects, nonpsychopathic controls responded slower on Q-present than on Q-absent trials, whereas the psychopathic offenders responded faster on Q-present trials (Newman, 1991). Consistent with our speculation, cues for punishment were less likely to engender an automatic interruption of goal-directed behavior in psychopaths than in nonpsychopathic controls.

Summary. Although numerous investigators (e.g., Eysenck, 1977, Newman et al., 1985) have attributed the impulsive behavior of psychopaths and neurotic extraverts to similar processes, there is increasing evidence that their impulsive responding, while similar in many respects, reflects different causal processes. Rather than a strong, rapid increase in arousal stemming from approach motivation (i.e., hypersensitivity to reward), the "impulsive" behavior of psychopaths appears to reflect difficulty in the automatic switching of attention which, in turn, interferes with their ability to assimilate unattended but potentially relevant information while they are engaged in the organization and implementation of goal-directed behavior. This characterization of the psychopath is consistent with the classic description provided by Cleckley (1976), who noted that psychopaths are not *driven* to antisocial behavior by strong urges for money, sex, or violence but that given some inducement to respond, they have little capacity for behavioral inhibition.

IMPLICATIONS FOR CHILDHOOD DISINHIBITION

Owing to space limitations which preclude a thorough review of the numerous and exciting links being forged between the self-regulatory problems of children and adults

(see Lillienfeld & Waldman, 1990; McBurnett, 1991; Quay, 1993) we will, of necessity, focus on bridging the gap between the foregoing discussion and the literature on childhood disinhibition while noting some of the more immediate implications and indications for future research.

First, just as the disinhibited behavior of adults may arise from diverse psychological processes, the behavior problems displayed by disinhibited children may also be understood as maladaptive expressions of BAS-mediated activation, BIS-mediated activation, and/or an intrinsic deficit in modulating response sets. Consider, for example, the traditional distinctions involving socialized, neurotic, and psychopathic delinquents (Quay and Parsons, 1970). These subtypes highlight three etiologically distinct pathways to conduct disorder (CD) that have much in common with the current framework (see also Quay, 1988). The socialized delinquent, for instance, maps well onto our first mechanism: Such individuals display disinhibited behavior in the context of reward seeking, including the approval of their peers, but there is little evidence of impaired interpersonal relationships, psychological deficits, or unusual levels of negative affect. The processes underlying the conduct problems displayed by neurotic/anxious delinquents appear related to our second mechanism: Such individuals appear to display disinhibited behavior in response to frustration, punishment, and anticipated rejection. Though apparently predisposed to deficient self-control and extreme violence under some circumstances, their behavior problems are thought to reflect maladaptive responses springing from negative affect. Psychopathic delinquents are distinguished by the difficulty that we have comprehending the motivation for their antisocial behavior and by the versatility of their conduct problems. This subtype relates to our third mechanism, which we have characterized as an intrinsic deficit in response modulation. Within this framework, the seemingly unpredictable nature of their conduct problems may reflect the psychopathic delinquents' more pervasive problem in self-regulation: They are at risk to respond inappropriately whenever situational factors engender an inclination to do so because they lack the associational framework that normally sustains behavior, moderates its intensity, and, if necessary, initiates active regulation of behavior.

The psychological pathways outlined in this paper are equally consistent with traditional distinctions made with regard to inappropriate aggression. Though different terms have been used, researchers typically distinguish between a predatory or instrumental form of aggression on the one hand and a hostile, reactive, and impulsive type of aggression on the other (Bandura, 1973; Berkowitz, 1974, 1990; Price & Dodge, 1989). Instrumental aggression is viewed as a type of goal-directed behavior that has much in common with the BAS-mediated activation that characterizes our first mechanism. By contrast, impulsive aggression (see Berkowitz, 1974) is engendered by negative affect and has much in common with the phenomenon of anxious impulsivity that we associated with the BIS (see Newman & Wallace, 1993c; Wallace et al., 1991). According to Dodge and his colleagues (Dodge & Crick, 1990; Dodge & Newman, 1981; Dodge, Price, Bachorowski, & Newman, 1990; see also Akhtar & Bradley, 1991), reactive aggression tends to be associated with information processing deficits which, in a manner analogous to the attentional problems associated with our second mechanism, result in the dysregulation of overlearned attentional, response, and attributional biases.

The framework outlined above prompts us to consider whether there exists a third predisposition to aggression (if not a third type of aggression) reflecting poor *constraint* as opposed to exaggerated approach motivation or excessive reactivity to negative affect. Although this type of aggression would resemble instrumental and reactive aggression because it would often be triggered by the same types of stimuli, it is likely to be distinguished by its more whimsical (i.e., poorly integrated) quality: When aggression is used

to achieve particular ends, it would, nevertheless, tend to be relatively unplanned and ineffective. Similarly, whereas lack of constraint would tend to disinhibit aggressive behavior following perceived insults and particular frustrations, relative to other forms of reactive aggression it would have less relation to a person's stable sensitivities than to the frustrations of the moment. Not coincidentally, this description aptly characterizes the aggression of psychopaths who display aggression in a wide variety of situations, including intentional intimidation designed to achieve an immediate goal, impulsive temper displays in response to immediate frustrations, and the commission of cruel and distasteful acts in response to trivial inducements (Cleckley, 1976; Williamson, Hare, & Wong, 1987). In light of other findings pertaining to psychopaths, we find it more plausible to attribute such aggression to an intrinsic deficit in response modulation as opposed to strong approach motivation or high levels of negative affect.

In contrast to the compelling parallels that exist in the CD and aggression literature, the relation of our three pathways to attention deficit hyperactivity disorder (ADHD) is less transparent. The regulatory problems demonstrated by ADHD children are relatively widespread. For example, in DSM-III (American Psychiatric Association, 1980) they included attentional problems, impulsive control problems, and hyperactivity. More recently, Douglas (1989) has organized their problems into four domains: regulating attention, inhibiting inappropriate responses, modulating arousal, and idiosyncratic responding to reinforcements.

Several authors have commented on the importance of situational factors for observing dysregulation in ADHD children including, but not limited to, the administration of rewards and punishments, occurrence of frustration, requirements for internal as opposed to external control, and others (Barkley, 1990; Douglas, 1983; Schachar, Rutter, & Smith, 1981). However, according to Douglas (1988) these apparently diverse influences may be usefully conceptualized as situations requiring self-regulation. Requirements to resist an immediate response inclination, to persevere in the face of boredom or frustration, and to organize appropriate behavior when confronted with novel situations all require self-regulation (see Kanfer & Gaelick, 1986).

Douglas's (1989) analysis is markedly similar to our conclusions regarding the widespread behavior problems of psychopaths and thus implicates our third pathway. That is, owing to their deficient response modulation, psychopaths are at risk of behaving inappropriately whenever there is a situational inducement to do so. Such situational factors include, but are not limited to, boredom, frustration, and opportunities for immediate gratification. Moreover, Barkley's (1990) characterization of ADHD children as deficient in "rule-governed" behavior mirrors our proposal that psychopaths are relatively unable to accommodate past associations while engaged in the effortful organization and implementation of goal-directed behavior (Newman & Wallace, 1993b). That ADHD children may experience higher concurrence costs in attempting to divide their attention (Schachar & Logan, 1990) is also consistent with our characterization of the psychopath's deficit and with findings reported by Kosson and Newman (1986). While we are cognizant of the essential factors differentiating psychopathy and ADHD as well as the reports showing that the severe conduct problems of ADHD children are relatively specific to ADHD children with comorbid CD or aggression, our assessment of the similarities is influenced primarily by the processes impeding self-regulation rather than the nature of the behavior escaping regulation. Although oversimplified, especially in ignoring ADHD subtypes, we believe that this simple analogy merits further investigation.

Our general framework complements several recent trends in childhood disinhibition. For example, several investigators have already discussed the potential utility of Gray's model for elucidating the psychological and physiological processes contributing to the

behavior problems of children and adolescents (e.g., Quay, 1988, 1993; Walker et al., 1991). Indeed, Quay (1988, in press) has even discussed specific relations between the components of Gray's model and the major categories of childhood psychopathology. Specifically, he has used Gray's model to differentiate the impulse control problems of unsocialized aggressive conduct disorder (UACD) and ADHD children, relating UACD to an overactive BAS and ADHD to an underactive BIS, and he has begun to organize the complex array of biochemical findings on CD in terms of activation, inhibition, and arousal processes (see also McBurnett, 1991).

Our framework is also compatible with a growing preference for conceptualizing behavior problems within a dimensional as opposed to a categorical framework. Achenbach (1993) has recently provided an eloquent exposition of this trend (see also Quay, 1986). A similar strategy involves Tremblay's (in press) use of Cloninger's three-dimensional model to investigate associations between personality and the development of antisocial behavior. Cloninger's dimensions of novelty seeking, harm avoidance, and reward dependence are rooted in "neurogenetic mechanisms" similar to Gray's and are quite compatible with the present proposals (see Cloninger, 1987).

Though less clearly related to the current framework, the emerging emphasis on diagnostic comorbidity indicates increasing acceptance of the diverse etiological processes that influence the expression of childhood disinhibition as well as an enhanced interest in integrating these processes. Seminal research by Milich and Loney (1979; Loney, Kramer, & Milich, 1982) implicated aggressiveness as a crucial factor moderating the link between ADHD and serious conduct problems (see also Murphy, Pelham, & Lang, 1992). More recently, Walker et al. (1991) documented the moderating effect of comorbid anxiety on CD: CD children with overanxious disorder displayed significantly less disturbance on measures of legal, school, and interpersonal impairment than CD children without comorbid anxiety. In contrast, the greatest risk for performance and social impairment is associated with comorbid CD and ADHD (Moffitt, 1990; Pihl, Peterson, & Finn, 1990). Walker, Lahey, Hynd, and Frame (1987), for instance, report that "children with both CD and ADD/H exhibited more physical aggression and a greater variety and severity of antisocial behaviors despite their younger age at the time of referral than children with CD alone" (p. 910). Finally, though not technically qualifying as comorbid syndromes, the socialized form of CD is less correlated with performance problems and dysfunctional relationships.

If, as appears to be the case in this literature, CD is regarded as a relatively nondescript category indicating that a young person has persistently behaved in a hostile/antisocial manner (akin to the adult diagnosis of antisocial personality disorder), then other individual difference variables such as the person's (a) capacity to be influenced by social rewards, (b) propensity for anxiety, and (c) intrinsic difficulty in regulating behavior may be regarded as separate, more specific, vulnerabilities to CD. Relatedly, these comorbid syndromes may represent diverse etiological pathways to disinhibitory psychopathology rather than discrete but overlapping categories of psychopathology (see also Achenbach, 1993). Moreover, if there exist children suffering from comorbid CD, anxiety, and ADHD, as seems likely, it may be expedient to conceptualize disinhibitory psychopathology as a manifestation of convergent individual difference variables and associated processing biases each meriting investigation in its own right. This dimensional approach to psychopathology is the hallmark of the biobehavioral models advanced by Eysenck (1967, 1981) and Gray (1987).

We hasten to point out that it would be extremely naive to regard individual differences in reward sensitivity, punishment sensitivity, or even intrinsic capacity for self-regulation as sufficient to engender disinhibitory psychopathology. Reward sensitivity may just as

easily facilitate a person's tendency to adopt societal norms and strive for material/social successes in a prosocial manner. Similarly, sensitivity to punishment may promote a cautious and responsible style of interacting with one's environment as well as an emotionally reactive one. Such differences in temperament are best regarded as processing biases which influence attentional and behavioral propensities but which are, nevertheless, shaped by other biologically based attributes, developmental experiences, concurrent situational influences, and their interactions. Finally, even though pervasive difficulties in regulating arousal, attention, and behavior may place a person at "high risk" for the type of experiences that contribute to an antisocial adjustment, there is abundant evidence that this outcome too is not inevitable. Even though such problems would interfere with the regulation of dominant responses, the nature of the responses escaping regulation will reflect a host of factors and would not necessarily involve aggressive or antisocial actions (see also Douglas, 1988).

SUMMARY

To summarize briefly, it is essential that we begin to characterize the psychological factors mediating the breakdown of self-regulation in disinhibited individuals. Moreover, if the expression of disinhibited behavior reflects diverse psychological processes, as appears likely, it will be necessary to develop multiple pathways to explain the self-regulatory problems of diverse groups.

Gray's model is very useful in this regard, and we have tentatively outlined three different pathways that may contribute to the self-regulatory problems of disinhibited individuals: Pathways I and II involve BAS- and BIS-mediated increases in NAS activity, respectively. Both pathways are hypothesized to result in high levels of NAS activity which (a) reduce opportunities for self-regulation by increasing the speed and force with which behavior is initiated and (b) reduce control processing resources available to support self-regulation by automatically directing attention to the immediate motivationally significant stimuli. The third pathway highlights a more intrinsic problem in accommodating the type of pertinent, though nondominant, information that both initiates and informs the self-regulation process (see Newman & Wallace, 1993b). Importantly, these pathways do not simply cite a weak BIS or strong BAS as the source of disinhibited behavior. Such differences may explain a person's inclination to emphasize potential rewards over potential punishments, but appear to overlook the essential problem: the processing limitations which interfere with a person's ability to simultaneously pursue rewards while monitoring, evaluating, and, if necessary, altering their behavior in light of more peripheral goals and considerations. Persistent difficulties of this type suggest a limitation in self-regulation that transcends stimulus sensitivities. In this presentation, we have highlighted two factors that may limit self-regulation: One involves high NAS activity and the second relates to the ease with which individuals automatically achieve perspective on their behavior (see also Patterson & Newman, 1993).

Throughout this paper, we have emphasized individual difference variables affecting self-regulation to the virtual exclusion of environmental factors. Yet there can be little doubt that such factors exert a potent influence on the development of aggression, conduct disorder, and other behaviors typically associated with disinhibition (e.g., Kazdin, 1992). In focusing on the psychological processes underlying self-regulatory failures, our goal is to provide a framework for studying the person by situation interactions, and thus the environmental factors, that shape the ultimate expression of a person's underlying temperament or diathesis (see Gorenstein & Newman, 1980). In other words, while focusing

on biologically based individual difference variables, we acknowledge that it is the person's specific experiences that will determine the cues that trigger the breakdown of regulatory processes as well as the dominant responses that will be released when regulatory processes fail.

REFERENCES

Achenbach, T. M. (1993). Taxonomy and comorbidity of conduct problems: Evidence from empirically based approaches. *Development and Psychopathology, 5*, 51-65.

Akhtar, N., & Bradley, E. J. (1991). Social information processing deficits of aggressive children: Present findings and implications for social skills training. *Clinical Psychology Review, 11*, 645-662.

American Psychiatric Association. (1980). *Diagnostic and statistical manual of mental disorder* (3rd ed.). Washington, DC: Author.

Arnett, P. A., Smith, S. S., & Newman, J. P. (1993). *Approach and avoidance motivation in incarcerated psychopaths during passive avoidance.* Manuscript submitted for publication.

Bachorowski, J., & Newman, J. P. (1990). Impulsive motor behavior: The effects of personality and goal salience. *Journal of Personality and Social Psychology, 58*, 512-518.

Bandura, A. (1973). *Aggression: A social learning analysis.* Englewood Cliffs, NJ: Prentice-Hall.

Barkley, R. A. (1990). Attention deficit disorders: History, definition, and diagnosis. In M. Lewis & S. M. Miller (Eds.), *Handbook of developmental psychopathology* (pp. 65-75). New York: Plenum Press.

Berkowitz, L. (1974). Some determinants of impulsive aggression: Role of mediated associations with reinforcements for aggression. *Psychological Review, 81*, 165-176.

Berkowitz, L. (1990). On the formation and regulation of anger and aggression: A cognitive-neoassociationistic analysis. *American Psychologist, 45*, 494-503.

Brebner, J., & Cooper, C. (1974). The effect of a low rate of regular signals upon the reaction times of introverts and extraverts. *Journal of Research in Personality, 8*, 263-276.

Cleckley, H. (1976). *The mask of sanity* (5th ed.). St. Louis, MO: Mosby.

Cloninger, C. R. (1987). Neurogenetic adaptive mechanisms in alcoholism. *Science, 23*, 410-415.

Dodge, K. A., & Crick, N. R. (1990). Social inforamtion-processing bases of aggressive behavior in children. *Personality and Social Psychology Bulletin, 16*, 8-22.

Dodge, K. A., & Newman, J. P. (1981). Biased decision-making processes in aggressive boys. *Journal of Abnormal Psychology, 90*, 375-379.

Dodge, K. A., Price, J. M., Bachorowski, J., & Newman, J. P. (1990). Hostile attributional tendencies in severely aggressive adolescents. *Journal of Abnormal Psychology, 99*, 385-392.

Douglas, V. I. (1983). Attentional and cognitive problems. In M. Rutter (Ed.), *Developmental neuropsychiatry* (pp. 280-329). New York: Guilford.

Douglas, V. I. (1988). Cognitive deficits in children with attention deficit disorder with hyperactivity. In L. M. Bloomingdale & J. Sergeant (Eds.), *Attention deficit disorder: Criteria, cognition, intervention* (pp. 65-81). Oxford, England: Pergamon.

Douglas, V. I. (1989). Can skinnerian theory explain attention deficit disorder?—A reply to Barkley. In L. M. Bloomingdale & J. Swanson (Eds.), *Attention deficit disorder: Current concepts and emerging trends in attentional and behavioral disorder of childhood* (pp. 235-254).

Eysenck, H. J. (1967). *Biological basis of personality.* Springfield, IL: Thomas.

Eysenck, H. J. (1977). *Crime and personality* (3rd ed.). London: Routledge and Kegan Paul.

Eysenck, H. J. (1981). General features of the model. In H. J. Eysenck (Ed.), *A model for personality* (pp. 1-37). New York: Springer-Verlag.

Eysenck, H. J., & Rachman, S. (1971). *Causes and cures of neurosis.* San Diego, CA: Robert R. Knapp.

Fowles, D. C. (1980). The three arousal model: Implications of Gray's two-factor learning theory for heart rate, electrodermal activity, and psychopathy. *Psychophysiology, 17*, 87-104.

Giancola, P., Peterson, J. B., & Pihl, R. O. (1993). Risk for alcoholism, antisocial behavior, and response perseveration. *Journal of Clinical Psychology, 49*, 423-428.

Gilbert, D. T. (1989). Thinking lightly about others: Automatic components of the social inference process. In J. S. Uleman & J. A. Bargh (Eds.), *Unintended thought* (pp. 189–211). New York: Guilford.

Gorenstein, E. E., & Newman, J. P. (1980). Disinhibitory psychopathology: A new perspective and a model for research. *Psychological Review*, 87, 301–315.

Gray, J. A. (1981). A critique of Eysenck's theory of personality. In H. J. Eysenck (Ed.), *A model for personality* (pp. 246–276). New York: Springer-Verlag.

Gray, J. A. (1982). *The neuropsychology of anxiety*. New York: Oxford University Press.

Gray, J. A. (1987). *The psychology of fear and stress*. New York: Cambridge University Press.

Gray, J. A. (1991). Neural systems, emotion and personality. In J. Madden (Ed.), *Neurobiology of learning, emotion and affect* (pp. 273–306). New York: Raven Press.

Gray, J. A., Owen, S., Davis, N., & Tsaltas, E. (1983). Psychological and physiological relations between anxiety and impulsivity. In M. Zuckerman (Ed.), *Biological bases of sensation seeking, impulsivity, and anxiety* (pp. 189–217). Hillsdale, NJ: Erlbaum.

Hare, R. D. (1991). *The Hare Psychopathy Checklist — Revised*. Toronto: Multi-Health Systems.

Hare, R. D., Hart, S. D., & Harpur, T. J. (1991). Psychopathy and the DSM-IV criteria for antisocial personality disorder. *Journal of Abnormal Psychology*, 100, 391–398.

Howland, E. W., Kosson, D. S., Patterson, C. M., & Newman, J. P. (1993). Altering a dominant response: Performance of psychopaths and low socialization college students on a cued reaction time task. *Journal of Abnormal Psychology*, 102, 379–387.

Howland, E. W., & Newman, J. P. (1987). *The effect of incentives on Wisconsin Card Sorting Task performance in psychopaths*. Unpublished manuscript.

Kanfer, F. H., & Gaelick, L. (1986). Self-management methods. In F. H. Kanfer & A. P. Goldstein (Eds.), *Helping people change: A textbook of methods* (3rd ed., pp. 283–345). Elmsford, NY: Pergamon.

Kazdin, A. E. (1992). Child and adolescent dysfunction and paths toward maladjustment: Targets for intervention. *Clinical Psychology Review*, 12, 795–818.

Kosson, D. S., & Newman, J. P. (1986). Psychopathy and the allocation of attention in a divided attention situation. *Journal of Abnormal Psychology*, 95, 252–256.

Lillienfeld, S. O., & Waldman, I. D. (1990). The relation between childhood attention-deficit hyperactivity disorder and adult antisocial behavior reexamined: The problem of heterogeneity. *Clinical Psychology Review*, 10, 699–725.

Loney, J., Kramer, J., & Milich, R. S. (1982). The hyperactive child grows up: Predictors of symptoms, delinquency, and achievement at follow-up. In K. D. Gadow & J. Loney (Eds.), *Psychosocial aspects of drug treatment for hyperactivity* (pp. 381–415). Boulder, CO: Westview Press.

Lykken, D. T. (1957). A study of anxiety in the sociopathic personality. *Journal of Abnormal and Social Psychology*, 55, 6–10.

McBurnett, K. (1991). Psychobiological approaches to personality and their applications to child psychopathology. In A. Kazdin & B. Lahey (Eds.), *Advances in clinical child psychology* (Vol. 14). New York: Plenum Press.

McCleary, R. A. (1966). Response-modulating function of the limbic system: Initiation and suppression. In E. Stellar & J. M. Sprague (Eds.), *Progress in physiological psychology* (Vol. 1). New York: Plenum Press.

Milich, R. S., Hartung, C., Martin, C., & Haigler, E. (1993, February). *Disinhibition and underlying processes in hyperactive and aggressive adolescents*. Paper presented at the annual meeting of the Society for Research on Child and Adolescent Psychopathology, Santa Fe, NM.

Milich, R. S., & Loney, J. (1979). The role of hyperactive and aggressive symptomatology in predicting adolescent outcome among hyperactive children. *Journal of Pediatric Psychology*, 4, 93–112.

Moffitt, T. E. (1990). Juvenile delinquency and attention deficit disorder: Developmental trajectories from age 3 to age 15. *Child Development*, 61, 893–910.

Murphy, D. A., Pelham, W. E., & Lang, A. (1992). Aggression in boys with attention deficit-hyperactivity disorder. Methylphenidate effects on naturalistically observed aggression, response to provocation, and social information processing. *Journal of Abnormal Child Psychology*, 20.

Newman, J. P. (1987). Reaction to punishment in extraverts and psychopaths: Implications for the impulsive behavior of disinhibited individuals. *Journal of Research in Personality*, 21, 464–485.

Newman, J. P. (1991, November). *Response modulation deficits in psychopaths*. Paper presented as part of a symposium on Neuropsychological Approaches to Antisocial Behavior at the annual meeting of the American Society of Criminology, San Francisco.

Newman, J. P., Gorenstein, E. E., & Kelsey, J. E. (1983). Failure to delay gratification in rats with septal lesions: Implications for an animal model of disinhibitory psychopathology. *Personality and Individual Differences*, 4, 147–156.

Newman, J. P., & Kosson, D. S. (1984, August). *Behavioral inhibition deficits in extraverts*. Poster presented at the meeting of the American Psychological Association, Toronto.

Newman, J. P., & Kosson, D. S. (1986). Passive avoidance learning in psychopathic and nonpsychopathic offenders. *Journal of Abnormal Psychology, 95,* 257–263.

Newman, J. P., Kosson, D. S., & Patterson, C. M. (1992). Delay of gratification of psychopathic and nonpsychopathic offenders. *Journal of Abnormal Psychology, 101,* 630–636.

Newman, J. P., Patterson, C. M., Howland, E. W., & Nichols, S. L. (1990). Passive avoidance in psychopaths: The effects of reward. *Personality and Individual Differences, 11,* 1101–1114.

Newman, J. P., Patterson, C. M., & Kosson, D. S. (1987). Response perseveration in psychopaths. *Journal of Abnormal Psychology, 96,* 145–148.

Newman, J. P., & Wallace, J. F. (1993a). Models and theories of psychopathy. In S. Hart & R. D. Hare (Eds.), *Psychopathy and the criminal justice system.*

Newman, J. P., & Wallace, J. F. (1993b). Psychopathy. In P. C. Kendall & K. Dobson (Eds.), *Psychopathology and cognition* (pp. 293–349). New York: Academic Press.

Newman, J. P., & Wallace, J. F. (1993c). Three pathways to impulsive behavior: Implications for violence and aggression. In L. Klose (Ed.), *Proceedings of the fourth symposium on violence & aggression* (pp. 95–113). Saskatoon, Saskatchewan: University of Saskatoon Press.

Newman, J. P., Wallace, J. F., Strauman, T. J., Skolaski, R. L., Oreland, K. M., Mattek, P. W., Elder, K. A., & McNeely, J. (1993). Effects of motivationally significant stimuli on the regulation of dominant responses. *Journal of Personality and Social Psychology, 65,* 165–175.

Newman, J. P., Widom, C. S., & Nathan, S. (1985). Passive-avoidance in syndromes of disinhibition: Psychopathy and extraversion. *Journal of Personality and Social Psychology, 48,* 1316–1327.

Nichols, S. L., & Newman, J. P. (1986). Effects of punishment on response latency in extraverts. *Journal of Personality and Social Psychology, 50,* 624–630.

Patterson, C. M., Kosson, D. S., & Newman, J. P. (1987). Reaction to punishment, reflectivity, and passive-avoidance learning in extraverts. *Journal of Personality and Social Psychology, 52,* 565–575.

Patterson, C. M., & Newman, J. P. (1993). Reflectivity and learning from aversive events: Toward a psychological mechanism for the syndromes of disinhibition. *Psychological Review, 100,* 716–736.

Pihl, R. O., Peterson, J., & Finn, P. (1990). Inherited predisposition to alcoholism: Characteristics of sons of male alcoholics. *Journal of Abnormal Psychology, 99,* 291–301.

Price, J. M., & Dodge, K. A. (1989). Proactive and reactive aggression in childhood: Relations to peer status and social context dimensions. *Journal of Abnormal Child Psychology, 17,* 455–471.

Pritchard, W. S. (1981). Psychophysiology of P300. *Psychological Bulletin, 89,* 506–540.

Quay, H. C. (1986). Classification. In H. C. Quay & J. S. Werry (Eds.), *Psychopathological disorders of childhood* (3rd ed. pp. 1–42). New York: Wiley.

Quay, H. C. (1988). The behavioral reward and inhibition system in childhood behavior disorder. In L. M. Bloomingdale (Ed.), *Attention deficit disorder* (Vol. 3, pp. 176–186). New York: Spectrum.

Quay, H. C. (1993). The psychobiology of undersocialized aggressive conduct disorder. *Development and Psychopathology, 5,* 165–180.

Quay, H. C., & Parsons, L. B. (1970). *The differential behavioral classification of the juvenile offender.* Washington, DC: U.S. Department of Justice, Bureau of Prisons.

Schachar, R., & Logan, G. (1990). Are hyperactive children deficient in attentional capacity? *Journal of Abnormal Child Psychology, 18,* 493–513.

Schachar, R., Rutter, M., & Smith, A. (1981). The characteristics of situationally and pervasively hyperactive children: Implications for syndrome definition. *Journal of Child Psychology and Psychiatry, 22,* 375–392.

Schmauk, F. J. (1970). Punishment, arousal, and avoidance learning in sociopaths. *Journal of Abnormal Psychology, 76,* 325–335.

Schneider, W., Dumais, S. T., & Shiffrin, R. M. (1984). Automatic and control processing and attention. In R. Parasuraman & D. R. Davies (Eds.), *Varieties of attention* (pp. 1–27). New York: Academic Press.

Schneider, W., & Shiffrin, R. M. (1977). Controlled and automatic human information processing: I. Detection, search, and attention. *Psychological Review, 84,* 1–66.

Shapiro, D. (1965). *Neurotic styles.* New York: Basic Books.

Shapiro, S. K., Quay, H. C., Hogan, A. E., & Schwartz, K. P. (1988). Response perseveration and delayed responding in undersocialized aggressive conduct disorder. *Journal of Abnormal Psychology, 97,* 371–373.

Siegel, R. A. (1978). Probability of punishment and suppression of behavior in psychopathic and nonpsychopathic offenders. *Journal of Abnormal Psychology, 87,* 514–522.

Smith, S. S., Arnett, P. A., & Newman, J. P. (1992). Neuropsychological differentiation of psychopathic and nonpsychopathic criminal offenders. *Personality and Individual Differences, 13,* 1233–1245.

Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E. (1970). *Manual for the State-Trait Anxiety Inventory.* Palo Alto, CA: Consulting Psychologists Press.

Tiffany, S. T. (1990). A cognitive model of drug urges and drug-use behavior: Role of automatic and nonautomatic processes. *Psychological Review, 97,* 147–168.

Tremblay, R. E. (in press). The prediction of delinquent behavior from childhood behavior: Personality theory revisited. In J. McCord (Ed.), *Crimes: Facts, fictions, and theory* (Vol. 3, Advances in Criminological Theory). New Brunswick, NJ: Transactions.

Tremblay, R. E. (1992). Unpublished data.

Walker, J. L., Lahey, B. B., Hynd, G. W., & Frame, C. L. (1987). Comparison of specific patterns of antisocial behavior in children with conduct disorder with or without coexisting hyperactivity. *Journal of Consulting and Clinical Psychology, 55*, 910–913.

Walker, J. L., Lahey, B. B., Russo, M. F., Frick, P. J., Christ, A. G., McBurnett, K., Loeber, R., Stoutham-er-Loeber, M., & Green, S. M. (1991). Anxiety, inhibition, and conduct disorder in children: I. Relations to social impairment. *Journal of the American Academy of Child and Adolescent Psychiatry, 30*, 187–191.

Wallace, J. F., Bachorowski, J., & Newman, J. P. (1991). Failures of response modulation: Impulsive behavior in anxious and impulsive individuals. *Journal of Research in Personality, 25*, 23–44.

Wallace, J. F., & Newman, J. P. (1990). Differential effects of reward and punishment cues on response speed in anxious and impulsive individuals. *Personality and Individual Differences, 11*, 999–1009.

Wallace, J. F., & Newman, J. P. (1993). *Neuroticism and the attentional mediation of dysregulatory psychopathology.* Manuscript submitted for publication.

Williamson, S., Hare, R. D., & Wong, S. (1987). Violence: Criminal psychopaths and their victims. *Canadian Journal of Behavioral Science, 19*, 454–462.

Williamson, S., Harpur, T. J., & Hare, R. D. (1991). Abnormal processing of affective words by psychopaths. *Psychophysiology, 28*, 260–273.